

Teaching Visual Thinking in Radiology

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*We have implemented a tutoring system, **Radiology Puzzler**, for teaching visual recognition of intracranial lesions on radiological images. The system is designed to support the learning of radiological patterns through graphical case retrieval. Using radiologic feature samplers, the user may define brain lesion characteristics and use visual query when searching for reference cases. A rule-based module generates a hierarchical list of diagnostic hypotheses and provides a feed-back to the user. Relevant cases that match the sampler's index are retrieved from the case library for comparison with the case in question.*

INTRODUCTION

Recent discoveries in cognitive psychology emphasize the importance and influence of visualization on thinking [1]. Images are easily remembered and give more information than words. It has been hypothesized that in a visual domain such as radiology, perceptual learning, the outcome of which is a differential diagnosis set with associated probabilities, occurs earlier in the course of learning than the cognitive learning that depends on products of the perceptual process [2]. Learning an extensive reference set is thus a necessary prerequisite for radiological diagnosis [3].

The **Radiology Puzzler** is a computerized tutoring system that is designed to emphasize visual thinking in radiology education [4]. The system is intended to help first year residents develop visual fluency, enhance visual memorization, and improve indexing of mental images used in radiological diagnosis. The system provides a teaching environment that combines text, image, video and audio, and intends to mimic a real one-to-one teaching environment. The user learns radiology visual language by making a visual pattern matching with interactive feed-back.

SYSTEM ARCHITECTURE

The **Radiology Puzzler** consists of five modules:

Case Library (CL) - is a database of radiologic cases. A case consists of images, with diagnosis and radiologic finding indexes, and captions. CL provides cases for both testing and reference purposes.

Visual Concept Library (VCL) - is a pictorial of radiological findings (set of samplers linked to the images in the CL) with voice annotations.

Tutor Knowledge Base (TKB) - is a rule-based module that identifies deficiencies in the user's knowledge, selects strategies to present that knowledge to the user, controls dialog sequences in the *Dialog Window*, and generates differential diagnoses.

Explanation Library (EL) - is a library of video clips and teaching images that are presented to the user in the interactive mode.

User Data File (UDF) - is a database that holds information about the user's performance during the tutoring session.

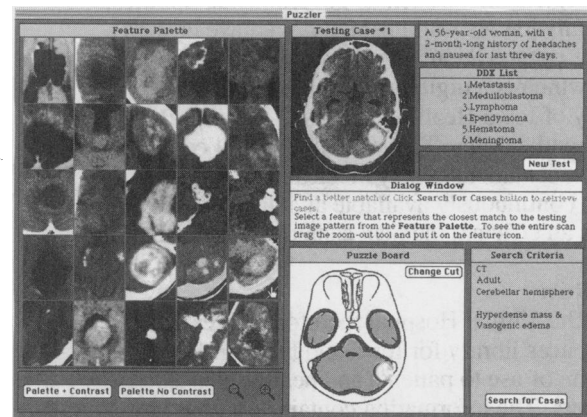


Figure 1. **Radiology Puzzler** screen

References

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4. Macura RT, Macura KJ, Trueblood JH, Binet EF. Radiology Puzzler: Artificial Intelligence-Based Game. Supplement to *Radiology* 1993; 189(P): 445-446.